UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 10 2014

OFFICE OF
AIR AND RADIATION

Mr. J. R. Stroble
Manager, TRU Sites and Transportation Division
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Mr. Stroble:

On October 18, 2013, the Carlsbad Field Office (CBFO) requested that, as a Tier 1 (T1) change, the U.S. Environmental Protection Agency (EPA) approve remote-handled (RH) transuranic (TRU) waste stream IN-ID-BTO-030 (Lot 3) at the Idaho National Laboratory (INL) for disposal at the Waste Isolation Pilot Plant (WIPP). EPA conducted an evaluation of the supporting documentation for this change in Denver, CO in December 2013. Subsequently, DOE revised a significant number of documents. These revisions required the U.S. Navy's approval prior to their release to EPA. We received these on July 31, 2014. EPA has reviewed the information provided and approves the addition of this waste stream to the previously approved RH waste streams for disposal at WIPP. The enclosed report (EPA Docket No. A-98-49; II-A4-191; EPA eDocket # EPA-HQ-OAR-2001-0012-0442) details EPA's evaluation. This approval also allows the future addition of additional waste to this stream with a similar waste pedigree (radiological and physical contents) and characterized using the EPA-approved processes discussed in the enclosed report.

If you have any questions regarding this approval, please contact Rajani Joglekar at (202) 343-9462 or Ed Feltcorn at (202) 343-9422.

Sincerely,

Tom Peake

Tom Peake, Director
Center for Waste Management and Regulations

Enclosure

cc: Electronic Distribution
Alton Harris, DOE EM
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Bruce LaRue, ID DEQ
Site Documents
Ray Lee, EPA

DOCKET NO: A-98-49; II-A4-191
EPA eDocket NO: EPA-HQ-OAR-2001-0012-0442

WASTE CHARACTERIZATION TIER 1 CHANGE REPORT

EPA TIER 1 EVALUATION OF THE CENTRAL CHARACTERIZATION PROGRAM REMOTE-HANDLED TRANSURANIC WASTE CHARACTERIZATION PROGRAM FOR THE IDAHO NATIONAL LABORATORY: ADDITION OF WASTE STREAM IN-ID-BTO-030

U.S. Environmental Protection Agency
Radiation Protection Division
Center for Waste Management & Regulations
1200 Pennsylvania Avenue, NW
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November 2014

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ABBREVIATIONS AND ACRONYMS

ACL	Analytical Chemistry Laboratory (AMWTP)
AK	acceptable knowledge
AKSR	acceptable knowledge summary report
AMWTP	Advanced Mixed Waste Treatment Project
BAPL	Bettis Atomic Power Laboratory
BDR	batch data report
CBFO	Carlsbad Field Office
CCP	Central Characterization Program
CFR	Code of Federal Regulations
Ci	curie
Cm	curium
CRR	Characterization Reconciliation Report
Cs	cesium
CWI	CH2M-WG Idaho
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Field Office
DTC	dose-to-curie
EPA	U.S. Environmental Protection Agency
HFEF	Hot Fuel Examination Facility
HLW	high-level waste
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LANL-CO	Los Alamos National Laboratory Carlsbad Office
m	meter
MEL	Materials Evaluation Laboratory (BAPL)
MFC	Materials and Fuels Complex (INL)
mR	milliroentgen
mR/hr	milliroentgens per hour
NNPP	U.S. Naval Nuclear Propulsion Program
NWP	Nuclear Waste Partnership
Pu	plutonium

QAO	quality assurance objective
R	roentgen
RH	remote-handled
SCG	Summary Category Group
SF	scaling factor
SNF	spent nuclear fuel
SPM	Site Project Manager
SRS-CCP	Savannah River Site Central Characterization Program
T1	Tier 1
T2	Tier 2
TMU	total measurement uncertainty
TRU	transuranic
U	uranium
WAP	waste analysis plan
WCPIP	Waste Characterization Program Implementation Plan
WIPP	Waste Isolation Pilot Plant
WSPF	waste stream profile form

1.0 INTRODUCTION

This report supports the U.S. Environmental Protection Agency's (EPA's) approval of a Tier 1 (T1) change to add Waste Stream IN-ID-BTO-030 to the approved characterization program at the U.S. Department of Energy's (DOE's) Idaho National Laboratory (INL). In January 2007, EPA approved the Central Characterization Program (CCP)[1] to characterize remote-handled (RH) waste at INL (see EPA Docket No. A-98-49; II-A4-72). Using the EPA-approved waste characterization processes discussed in this report, INL-CCP may characterize Waste Stream IN-ID-BTO-030 for disposal at the Waste Isolation Pilot Plant (WIPP).

EPA conducted continued compliance inspections of INL-CCP in May 2013 and May 2014, concluding in both instances that INL-CCP continued to adequately implement the RH transuranic (TRU) waste characterization processes, procedures and equipment at INL that EPA approved in the January 2007 baseline approval and in subsequent tiering changes listed in Attachment A.

On September 30, 2013, the Carlsbad Field Office (CBFO) requested EPA approval of a T1 change to include Waste Stream IN-ID-BTO-030. EPA limited the scope of this T1 evaluation to the components of acceptable knowledge (AK) and radiological characterization specific to the addition of Waste Stream IN-ID-BTO-030. Because there were no new equipment or additional new processes on site at INL as part of the T1 request, EPA conducted a desktop review of this change and then met with INL-CCP personnel in Denver, Colorado, on December 3–5, 2013. EPA did not identify any findings or concerns during this evaluation. Subsequent to the desktop review, INL-CCP revised several documents and calculation packages and provided them to EPA in August 2014,[2] as discussed in section 6.0 of this report. Attachment C is a list of all documents reviewed, including batch data reports (BDRs) and calculation packages.

As a result of this evaluation, EPA did not make any changes to the INL-CCP RH T1 and Tier 2 (T2) designations that were established during the baseline approval and modified during subsequent T1 evaluations and continued compliance inspections. The tiering designations presented in Table 1 of the final report for EPA's 2014 continued compliance inspection of INL-CCP (see EPA Docket No. A-98-49; II-A4-190; July 15, 2014) remain in effect and are listed as applicable in sections 6.1 and 6.2.

Based on the information provided, EPA is approving INL-CCP's characterization of four 55-gallon drums comprising of Waste Stream IN-ID-BTO-030 using the EPA-approved system of controls. This approval also includes any additional drums that may be added to Waste Stream IN-ID-BTO-030 in the future, provided they have the same pedigree as the original four containers and are characterized using the EPA-approved processes discussed in this report.

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[1] The Central Characterization Program was formerly known as the Central Characterization Project, and both names are used in the documentation reviewed for this evaluation.

[2] All revised documents required a review by the U.S. Naval Nuclear Propulsion Program (NNPP) using Public Utterance, a process similar in nature to a classification review. This process is time consuming and resulted in considerable delay in processing this T1 evaluation, see page 7 of this report.

This report serves as EPA's public notification of the results of the proposed T1 change and its evaluation. This information will be provided through the EPA website and by emails to the WIPPNEWS list, in accordance with Title 40 of the Code of Federal Regulations [40 CFR 194.8(b)(3)].

2.0 PURPOSE OF TIER 1 EVALUATIONS

Certain changes to the waste characterization activities from the date of the site's baseline inspection must be reported to and, if applicable, approved by EPA according to the tiering requirements set forth in 40 CFR 194.8 regulations and incorporated into the INL-CCP RH baseline final report (see EPA Docket No. A-98-49; II-A4-72).

Under the changes to 40 CFR 194.8 promulgated in the July 16, 2004, Federal Register notice (Vol. 69, No. 136, pages 42571–42583), EPA must perform a single baseline inspection of a TRU waste generator site's waste characterization program. The purpose of EPA's baseline inspection is to approve the site's waste characterization program, based on the demonstration that the program's components, with applicable conditions and limitations, can adequately characterize TRU wastes and comply with the regulatory requirements imposed on TRU wastes destined for disposal at the WIPP.

Following EPA's baseline approval, EPA is authorized to evaluate and approve changes, if necessary, to the site's approved waste characterization program by conducting additional inspections under the authority of 40 CFR 194.24(h). Changes requiring EPA notification and approval prior to implementation (T1) and those requiring post-implementation notification (T2) are identified in the site-specific baseline inspection reports and subsequent T1 evaluation reports. When evaluating proposed T1 changes for approval, EPA may conduct a site inspection to observe implementation of the change or can opt to conduct a desktop review of information provided specific to a change. DOE may choose to characterize and dispose of any previously approved TRU waste using processes, procedures or equipment implemented as T2 changes at risk of subsequent EPA disapproval.

3.0 PURPOSE OF THIS REPORT

This report presents the results of EPA's evaluation of a T1 change to add Waste Stream IN-ID-BTO-030 to the EPA-approved waste characterization program, as described in CCP-AK-INL-590, Revisions 3 and 4; CCP-RC-INL-591, Revisions 0 and 1; and CCP-AK-INL-592, Revisions 1 and 2. This report presents the technical basis for and results of EPA's approval decision. EPA's approval decision regarding the addition of Waste Stream IN-ID-BTO-030 has been conveyed to DOE separately by letter. EPA will also announce the decision on its website at www.epa.gov/radiation/wipp, in accordance with 40 CFR 194.8(b)(3).

4.0 SCOPE OF THE TIER 1 EVALUATION

The scope of EPA's T1 evaluation is the AK and radiological characterization approach used to characterize the four RH TRU 55-gallon drums in Waste Stream IN-ID-BTO-030. Sections 6.1 and 6.2 of this report detail the AK and radiological characterization technical elements assessed during this evaluation.

5.0 EVALUATION PERSONNEL

5.1 EPA Evaluation Personnel

The EPA evaluation team members consisted of the personnel listed in Table 1 with their technical areas of expertise.

Table 1. EPA Tier 1 Evaluation Team Members

Name	Affiliation & Function
Ed Feltcorn	Lead Inspector, EPA
Connie Walker	Technical Evaluator – Acceptable Knowledge, SC&A
Rose Gogliotti	Technical Evaluator – Radiological Characterization, SC&A
Patrick Kelly	Technical Evaluator – Radiological Characterization, SC&A
Amir Mobasheran*	Technical Evaluator – Radiological Characterization, SC&A

*Participated remotely in Denver 2013 evaluation.

5.2 DOE Evaluation Personnel

EPA and its support personnel conducted interviews with INL-CCP waste characterization personnel in several disciplines. The INL-CCP personnel contacted during the T1 evaluation in Denver, Colorado, are listed in Table 2 with their affiliations and areas of expertise or function. All DOE personnel present at the evaluation are listed in Attachment B.

Table 2. DOE Tier 1 Evaluation Personnel

Name	Affiliation & Function
Lisa Watson	INL-CCP, AK Expert
Derek Ott	URS, Radiological Characterization Technical Expert
Thomas Clements	CWI-INL, TRU Project Manager (Evaluation Observer)
Irene Joo	URS, CCP RH Support/SPM
Marcus Pinzel	CBFO, RH Staff (Evaluation Observer)

6.0 TECHNICAL EVALUATION

Waste-Generating Activities and Packaging Configuration

Analysis of post-irradiated nuclear fuel assemblies from the NNPP generated Waste Stream IN-ID-BTO-030. Specifically, this Summary Category Group (SCG) S3000 (homogenous solids) waste stream consists of solidified particulate matter and pieces (fines) produced by sectioning, grinding, mounting, and polishing of metallographic fuel specimens. These fines were subsequently solidified in the Bettis Atomic Power Laboratory's (BAPL's)[3] Materials Evaluation Laboratory (MEL) from 1977 to 1985. BAPL initially placed the fines in containers and subsequently transferred them to 13 IN-41[4] cans. BAPL solidified the fines using Portland cement and water between 1987 and 1988. BAPL then shipped the resulting solid, monolith

[3] BAPL is located in West Mifflin, Pennsylvania.

[4] The BAPL IN-41 can is a stainless steel cylinder with an approximate diameter of 5 inches, length of 16 inches, and wall thickness of 0.25 inches.

wastes to the INL Materials and Fuels Complex (MFC)[5] for venting and repackaging into two Hot Fuel Examination Facility (HFEF) liners.[6] INL transferred the two liners to the Intermediate Level Transuranic Storage Facility for interim storage and later transferred them to Idaho Nuclear Technology and Engineering Center (INTEC) for final repackaging and characterization.

At INTEC in November 2011, INL repackaged the HFEF liners into four 30-gallon drums and overpacked the 30-gallon drums into four 55-gallon drums. Three of the 55-gallon drums contain three IN-41 cans plus a dummy schedule 40 open-ended pipe; one 55-gallon drum contains four IN-41 cans (Reference CCP-AK-INL-590, Revision 4). These four 55-gallon drums constitute Waste Stream IN-ID-BTO-030, which INL-CCP also calls "Lot 3."

Documents, Batch Data Reports and Calculation Packages Provided

EPA evaluated the INL-CCP documentation that supported the addition of Waste Stream IN-ID-BTO-030. EPA's review identified several technical issues that necessitated the revision of several documents. INL-CCP discussed proposed modifications to these documents with EPA during the December 2013 meeting in Denver, Colorado, and provided approved revised documents incorporating necessary changes to EPA in August 2014. EPA reviewed the revised documents prior to completing this report. Specifically, the primary documents supporting AK and radiological characterization required revisions and these revisions took approximately seven months to complete due to the public utterance process discussed in footnote 1. The affected documents were CCP-AK-INL-590, CCP-AK-INL-592, CCP-RC-INL-591, INL-RH-127, INL-RH-129 and DTC BDR INLRHDTC13009.

The DOE documents that EPA reviewed for this evaluation, including BDRs and calculation packages, are cited in different sections throughout the report and are listed in Attachment C. Any of these documents can be requested from the following address:

Manager, National TRU Sites and Transportation Division
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

6.1 Acceptable Knowledge

EPA examined INL-CCP's programmatic requirements and AK process and associated information during the continued compliance inspection in May 2013. Therefore, EPA limited the scope of this AK evaluation to those elements necessary to assess the technical adequacy of the information supporting the addition of Waste Stream IN-ID-BTO-030.

[5] The INL MFC was formerly known as Argonne National Laboratory-West.

[6] "HFEF liners" are RH containers specific to the Hot Fuel Examination Facility (HFEF) at MFC, as described in Docket No. A-98-49; II-A4-122.

Waste Characterization Element Description

EPA limited this T1 evaluation to the technical elements listed below.

- Waste stream definition, including waste generation and radiological and physical characteristics.
- Identification of the Waste Characterization Program Implementation Plan (WCPIP)[7] waste characterization process.
- Adequacy of the certification plan and other WCPIP documentation.
- Verification that the subject waste is of defense origin and is not high-level waste (HLW) or spent nuclear fuel (SNF).
- Role of AK in the characterization methodology, including radionuclide scaling factors.
- Adequacy of the AK procedure and its implementation, including attachments and AK accuracy reports.
- Adequacy of the acceptable knowledge summary report (AKSR) and associated source documents.
- Adequacy of the waste stream profile form (WSPF) and related attachments.

Technical Evaluation

(1) EPA examined the waste stream determination for Waste Stream IN-ID-BTO-030 and found it to be adequate.

Waste Stream IN-ID-BTO-030 is defined in the AKSR (CCP-AK-INL-590). At the December 2013 meeting in Denver, EPA reviewed Revision 3 of the AKSR and determined that it required revision to support the waste stream determination [see Item (6), below]. Upon review of the revised document, EPA determined that the waste stream is adequately defined.

As described in section 6.0 of this report, Waste Stream IN-ID-BTO-030 contains solidified particulate matter and pieces produced by sectioning, grinding, mounting, and polishing of metallographic specimens at BAPL. The final volume of wastes in these four containers intended for shipment to WIPP is 0.832 cubic meters. The waste stream's two predominant radionuclides by mass are thorium-232 (76.92%) and uranium-235 (^{235}U) (21.16%). The two predominant radionuclides by activity are cesium-137 (^{137}Cs) (17.73%) and yttrirum-90 (17.51%) (References CCP-AK-INL-590, Revision 4, and C127, C206, C207, C208, C209, C210, C313, U212, U213, U217, U221, U236, U277 and U366).

EPA did not identify any concerns regarding INL-CCP's waste stream determination for Waste Stream IN-ID-BTO-030.

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[7] All references to the WCPIP in this report refer to Revision 3, unless specified otherwise. U.S. Department of Energy, Carlsbad Field Office, "Remote Handled TRU Waste Characterization Program Implementation Plan," Revision 3, Carlsbad, New Mexico, September 19, 2012.

(2) INL-CCP identified the waste characterization pathway, and documentation of the approach is adequate.

The certification plan for Waste Stream IN-ID-BTO-030 (CCP-AK-INL-592) describes the characterization pathway, which uses a combination of AK, sampling and analysis, dose-to-curie (DTC), and nondestructive examination. The certification plan also presents quality assurance objectives (QAOs) and data quality objectives related to container acceptance criteria, physical properties acceptance criteria, physical form, surface dose rate, TRU alpha activity concentration, radionuclide activity and waste origin.

The certification plan indicates that INL-CCP sampled the 13 IN-41 cans during two separate events. INL-CCP performed the first event to support Resource Conservation and Recovery Act (RCRA)[8] constituent analysis required by the waste analysis plan (WAP).[9] When the Advanced Mixed Waste Treatment Project's (AMWTP's) Analytical Chemistry Laboratory (ACL) at INL determined that eight samples were required for radionuclide analyses, INL-CCP selected three additional containers at random, bringing the total radionuclide samples to eight. The AMWTP ACL analyzed these eight samples using a variety of analytical techniques, as discussed in section 6.2. INL-CCP met the characterization requirements for physical parameters and prohibited items using radiography.

EPA determined that Revision 1 of the certification plan outlined the characterization approach however, did not adequately address all aspects of laboratory analysis and AK QAOs. Specifically, the certification plan required revision with respect to sampling representativeness and RH determination QAOs for precision, accuracy and completeness. The certification plan also required revision to address AK QAOs associated with defense, HLW and SNF determinations. INL-CCP provided the March 2014 revision of the certification plan (CCP-AK-INL-592, Revision 2) on July 31, 2014, and EPA determined that it addressed all pertinent issues as well as other editorial and technical clarifications.

EPA did not identify any concerns regarding INL-CCP's documentation of the characterization pathway. Notification to EPA of availability of a revised certification plan remains a T2 change.

(3) EPA examined the waste stream information that supports the absence of spent nuclear fuel or high-level waste in this waste stream and found it to be adequate.

The WIPP Land Withdrawal Act prohibits the disposal of SNF and HLW as defined by the Nuclear Waste Policy Act at the WIPP. Waste Stream IN-ID-BTO-030 consists of solidified fuel fines, swarf[10] and other fragments generated through destructive examination of test specimens of spent fuel from various sources. The waste is not composed of complete or intact fuel material and does not include any material generated through separation or reprocessing of spent fuels; therefore, it is not HLW (References C206, P100, U201, U212, U213, U217, U221, U236, U237 and U256).

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[8] RCRA generally regulates hazardous materials.

[9] The WAP is under the purview of the New Mexico Environment Department.

[10] *Swarf* is material produced by a cutting or grinding process.

EPA did not identify concerns regarding INL-CCP's documentation of the absence of SNF and HLW in Waste Stream IN-ID-BTO-030.

(4) EPA examined the information supporting that the waste stream is defense in origin and found it to be adequate.

Revision 3 of the AKSR provided evidence to demonstrate that Waste Stream IN-ID-BTO-030 contains materials from atomic energy activities associated with naval reactors and research and development activities. However, the AKSR, Revision 3, defense discussion did not sufficiently reference or address this statement and was unclear regarding comingling of defense and non-defense wastes. INL-CCP provided Revision 4 of the AKSR, which better discussed the defense waste generation (References U201 and U256) and adequately supported the defense determination for Waste Stream IN-ID-BTO-030.

EPA did not identify any concerns regarding INL-CCP's documentation of the defense determination.

(5) EPA examined implementation of the acceptable knowledge procedure and related attachments and found them to be adequate.

CCP-TP-005 includes several attachments that document AK requirements. EPA found that the indicated waste generation dates differed between the AKSR, Revision 3; CCP-TP-005, Attachment 8, "Waste Containers List"; and other references. Additionally, the CCP TRU Waste Correlation and Surrogate Summary Form (Attachment 15) did not reference the correct discrepancy resolution analysis.

INL-CCP revised Attachments 8 and 15 and EPA reviewed draft copies of these attachments. The revised documents demonstrated that INL-CCP can adequately implement CCP-TP-005, Revision 26. EPA did not identify any concerns regarding INL-CCP's implementation of the appropriate AK attachments for Waste Stream IN-ID-BTO-030.

(6) EPA examined the acceptable knowledge summary report, associated source documents and reference list and found them to be adequate.

Upon initial evaluation, EPA determined that the AKSR, Revision 3, required the following modifications:

- Justify the SCG assignment.
- Clarify the solidification process with respect to appropriate packaging configuration.
- Better describe and justify the defense determination process.
- More thoroughly reference the HFEF repackaging process.
- Better describe the location and activities associated with the solidification process.
- Improve referencing throughout.

INL-CCP provided Revision 4 of the AKSR on July 31, 2014. EPA examined the AKSR, Revision 4, and associated source documents and reference list and found them to be adequate. EPA compared CCP-TP-005, Attachment 1; CCP-TP-005, Attachment 4; and the AKSR

reference list to determine whether the AK reference list items were all presented on Attachment 4 and the associated checklist. EPA determined that the attachments and AKSR checklist adequately presented all required aspects.

EPA did not identify any concerns regarding the adequacy of the AKSR and its reference list for Waste Stream IN-ID-BTO-030. Notification to EPA of availability of a revised AKSR remains a T2 change.

(7) EPA examined the draft waste stream profile form and attachments and found them to be adequate.

EPA's review of the draft WSPF indicated that it contained several inconsistencies and errors, including waste stream volume, footnotes and document citations. The draft Characterization Reconciliation Report (CRR) also contained several errors, including identification of the SCG, citations for the defense determination, nondestructive examination citations and BDR identification. Despite their draft status, EPA determined that the number of errors in the WSPF and CRR showed inattention to detail. INL-CCP revised both documents and provided the revised draft WSPF and draft CRR. EPA examined both and found them to be adequate.

EPA did not identify any concerns regarding the adequacy of the draft WSPF and draft CRR for Waste Stream IN-ID-BTO-030. Notification to EPA of availability of the final approved WSPF remains a T2 change.

Summary of Acceptable Knowledge Findings and Concerns

The EPA evaluation team did not identify any AK-related findings or concerns relative to the addition of Waste Stream IN-ID-BTO-030 during this T1 change evaluation.

Acceptable Knowledge Approval

Based on the results of this evaluation, EPA approves the addition of Waste Stream IN-ID-BTO-030 and finds that all requirements have been met. Based on this evaluation, there are no changes to the AK T1 or T2 designations. Characterization of any new waste stream not approved under the baseline or subsequent T1 evaluations or addition of containers to an approved waste stream that requires changing the established radionuclide scaling factors remains a T1 change. The tiering designations presented in Table 1 of the final report for EPA's 2014 continued compliance inspection of INL-CCP (see EPA Docket No. A-98-49; II-A4-190; July 15, 2014) remain in effect.

6.2 Radiological Characterization

EPA examined the DTC process and associated information during the continued compliance inspection in May 2013. Therefore, EPA limited the scope of this radiological characterization evaluation to those elements necessary to assess the technical adequacy of the information supporting characterization of Waste Stream IN-ID-BTO-030.

Waste Characterization Element Description

EPA evaluated the radiological characterization of INL-CCP RH Waste Stream IN-ID-BTO-030 in terms of its technical adequacy, as supported by the program's documents, procedures and controls and by the knowledge and understanding of the personnel involved in the RH waste characterization program. During this RH evaluation, the EPA team evaluated the following elements of the INL-CCP radiological characterization program:

- Overall radiological characterization.
- Collection of representative cored samples.
- Evaluation of measurement data to support the scaling factor development.
- Adequacy of the modeling approach, using MicroShield®.
- Development of the DTC correlation and determination of radionuclides within each drum.
- Uncertainty analysis.

Each of these is discussed in the sections that follow.

Technical Evaluation

EPA evaluated the adequacy of the radiological characterization process specific to Waste Stream IN-ID-BTO-030, as described in CCP-RC-INL-591, Revisions 0 and 1, and supporting calculation packages.

(1) EPA evaluated the overall radiological characterization process and its documentation and found them to be adequate.

The radiological characterization process for Waste Stream IN-ID-BTO-030 uses sampling and laboratory analysis to determine ^{137}Cs-based scaling factors, MicroShield® modeling, gamma dose measurements and density measurement to execute the DTC method. The EPA evaluation team prepared a flow diagram to reflect this process, shown in Figure 1, below. EPA determined that the radiological characterization process for Waste Stream IN-ID-BTO-030 was technically adequate and appropriately documented.

Consistent with the T1 and T2 designations that were established during the baseline approval, any new RH waste stream not approved to date or the addition of containers to Waste Stream IN-ID-BTO-030 that requires a radiological characterization process different from what is documented in CCP-RC-INL-591, Revision 1, remains a T1 change. Similarly, any change to CCP-RC-INL-591 that requires CBFO approval remains a T2 change

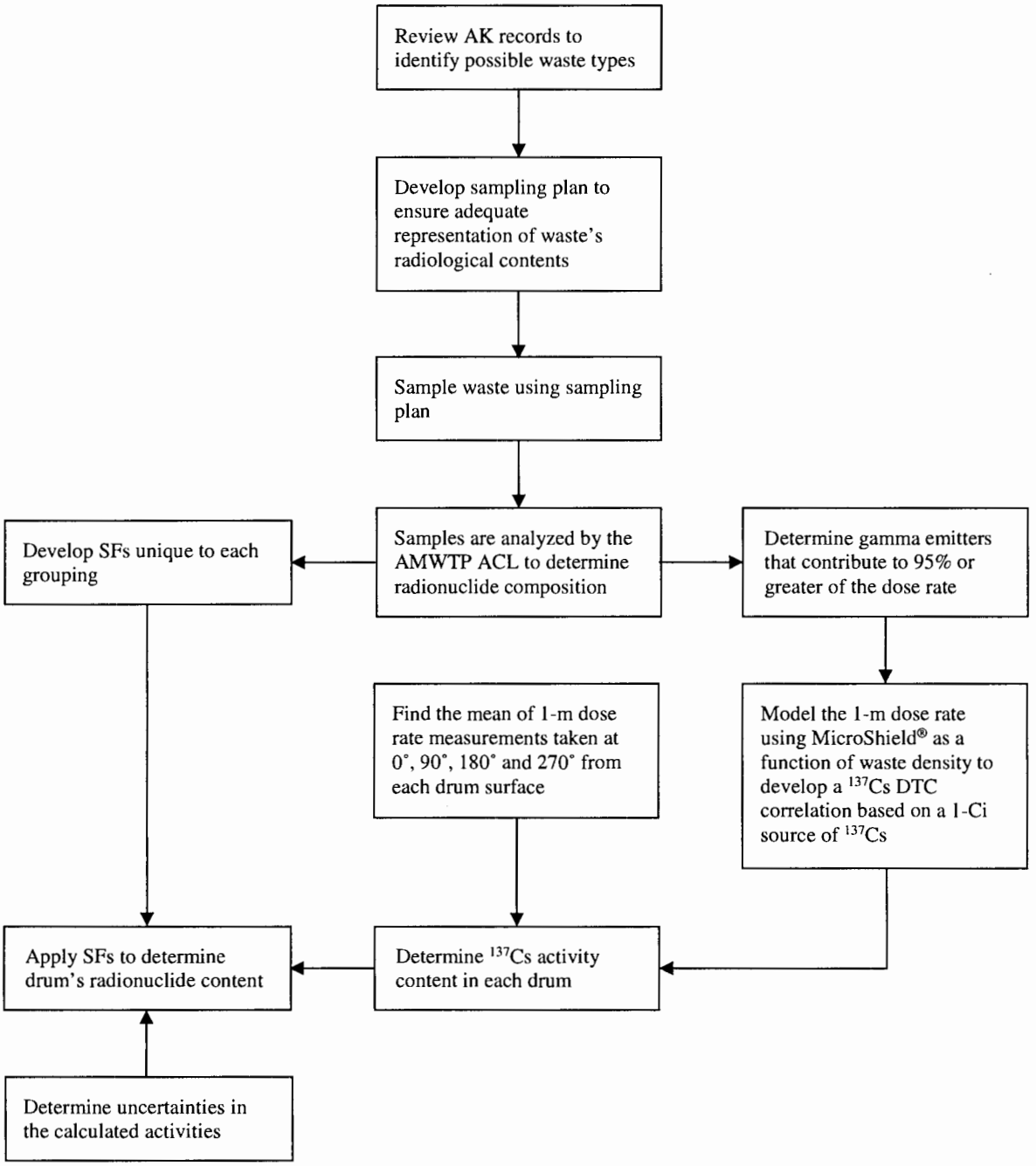

Figure 1. Radiological Characterization Flow Diagram for Waste Stream IN-ID-BTO-030

(2) EPA found the sampling of this waste stream to be representative, technically adequate and appropriately documented.

Considering the nature of the RH waste as originating from fuel specimens representing a variety of fuel types, INL-CCP developed a sampling and analysis plan, CCP-AK-INL-595A, to collect representative samples by collecting drill cuttings from each of the cemented sludges, as documented in two sampling BDRs. Based on reviews of sampling BDRs IDRH1101 (5

samples) and IDRH1201 (3 samples), EPA found that INL-CCP met the objective of obtaining representative samples. EPA did not identify any concerns regarding the representativeness of the sampling of containers in Waste Stream IN-ID-BTO-030.

(3) EPA found that the analytical data used to support the development of scaling factors were adequate for their intended use.

The sampling and analysis plan for Waste Stream IN-ID-BTO-030 provided specific sampling guidelines, as discussed above in (2), above. INL-CCP submitted the eight samples to AMWTP's ACL at INL. Laboratory analyses included alpha and gamma spectrometry, total beta counting and inductively coupled plasma-mass spectrometry. The ACL reported radionuclide concentrations in units of picocuries per gram for ^{137}Cs, cobalt-60, europium-154, strontium-90, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, plutonium-238 (^{238}Pu), ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, americium-241, curium-242 (^{242}Cm), ^{244}Cm and ^{245}Cm. Due to the limitations of alpha spectrometry, which does not allow adequate separation of ^{233}U/^{234}U and ^{235}U/^{236}U, the ACL reported concentrations for these radionuclides as the sum of each pair. The ACL provided BDRs for each analytical technique. EPA reviewed the ACL BDRs and found them to be technically adequate.

EPA did not identify any concerns regarding the use of the ACL radiometric and spectrometric data to support the development of radionuclide scaling factors for Waste Stream IN-ID-BTO-030.

(4) EPA evaluated the development of scaling factors and found it to be adequate.

The generation of radionuclide scaling factors is documented in INL-RH-125, and INL-CCP performed the supporting calculations in the Excel® file, "Lot 3 Sample Data." Supplemental information is contained in the post-sampling memorandum dated February 25, 2013. Based on the ACL analytical data, INL-CCP determined that ^{137}Cs was the largest gamma emitter and contributed at least 95% of the 1-meter (m) dose rate.[11] INL-CCP used ^{137}Cs as the basis for the Waste Stream IN-ID-BTO-030 scaling factors and did not make adjustments for other gamma-emitting radionuclides.

INL-CCP calculated the ratios of the radionuclide activities to ^{137}Cs activity for each sample using a log-normal distribution. For each radionuclide of interest, INL-CCP used the geometric mean of its scaling factors to represent the scaling factor for the radiological characterization of the waste stream. EPA reviewed the documentation supporting the scaling factor calculations and found it to be technically adequate and appropriately documented. EPA did not identify any concerns regarding the technical development and documentation of scaling factors for Waste Stream IN-ID-BTO-030.

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[11] "Rem" or "millirem" is a unit of dose equivalent, which is often commonly called "dose." Or, when it is expressed per unit time, "dose rate." The criterion for RH determination is expressed in terms of a dose rate in rem, which, while technically incorrect, is commonly used. Additionally, gamma measurements which technically represent exposure in roentgens (R) or milliroentgens (mR) are commonly misstated in rem. In this report, the terms "dose" and "dose rate" are used in place of the technically correct term "dose equivalent" or "dose equivalent rate," and the terms "R" and "rem" are used interchangeably. The actual differences among these values for the purpose of this report are negligible.

(5) EPA evaluated the MicroShield® modeling and dose-to-curie execution and found them to be adequate.

The modeling for the development of the DTC correlation is documented in INL-RH-127, Revision 2, and INL-CCP performed the DTC execution calculations in the Excel® file "DTC for IN-ID-BTO-030." Using MicroShield®, INL-CCP modeled a 1-curie (Ci) source of ^{137}Cs uniformly distributed within the waste in seven configurations of waste packaging that reflect best-estimate and bounding configurations. These included three-container and four-container configurations and a no-lid configuration and resulted in a representative DTC factor of 96 milliroentgens per hour per curie to be used for all four drums.

EPA's initial review of the assumptions used to model the waste configurations in INL-RH-127, Revision 0, indicated an error in the source-to-detector distance. INL-CCP provided INL-RH-127and the MicroShield® modeling attachments to correct the errors and other minor changes. EPA determined that the modeling adequately represents the solidified wastes in Waste Stream IN-ID-BTO-030.

INL-CCP executed DTC in accordance with CCP-TP-504, Revision 13, as documented in BDR No. INLRHDTC13009. Upon initial review, EPA determined that this BDR required minor changes. INL-CCP incorporated these in the May 28, 2014, revision which contained all appropriate elements, including the use of the single set of scaling factors for all four drums, successful achievement of all measurement acceptance criteria, and the review of the BDR data validation under CCP-TP-504, Revision 15. EPA did not identify any concerns regarding the execution and documentation of DTC for Waste Stream INL-ID-BTO-030.

(6) EPA evaluated the remote-handled determinations and found them to be adequate.

INL-CCP documented the RH determinations for containers in Waste Stream INL-ID-BTO-030 in radiological survey reports that INL-CCP collected in April 2013. EPA reviewed the RH determinations for all four 55-gallon drums. All drums had contact dose rates of greater than 3000 milliroentgens per hour, which meets the RH requirement of greater than 200 millirem per hour. EPA is satisfied that the four containers in Waste Stream INL-ID-BTO-030 meet the criteria for RH waste.

(7) EPA evaluated the transuranic determinations and found them to be adequate.

BDR No. INLRHDTC13009 lists all four containers in Waste Stream INL-ID-BTO-030. INL-CCP found each container to have a TRU concentration greater than 100 nanocuries per gram, as required to meet the definition of TRU waste. EPA is satisfied that containers in Waste Stream INL-ID-BTO-030 meet the criteria for TRU waste.

(8) EPA evaluated the technical basis and documentation of total measurement uncertainty and found them to be adequate.

The development of total measurement uncertainty (TMU) for Waste Stream IN-ID-BTO-030 is based on the propagation of uncertainties contributed by various aspects of the radiological characterization process. These aspects are assumed to be independent, allowing them to be

added in quadrature.[12] The TMU determination included uncertainty contributions of the following:

- ^{137}Cs DTC correlation – waste density, MicroShield® code and modeling uncertainties.
- ^{137}Cs activity measurement (dose rate measurement) – instrument and distance measurement uncertainties and uncertainty in the dose contribution of other gamma-emitting radionuclides.
- Scaling factor determination – uncertainty in sample data.

A general treatment of TMU for Waste Stream IN-ID-BTO-030 is presented in CCP-RC-INL-591, Revision 1, and the detailed treatment is provided in INL-RH-128. Table 7-3 of CCP-RC-INL-591, Revision 1, provides an example TMU calculation. The overall uncertainties are consistent with what EPA has observed for RH determinations at other RH TRU generator sites. EPA did not identify any concerns regarding the technical adequacy or documentation of TMU for Waste Stream IN-ID-BTO-030.

Summary of Radiological Characterization Findings and Concerns

EPA did not identify any radiological characterization-related findings or concerns relative to the addition of Waste Stream IN-ID-BTO-030 during this T1 change evaluation.

Radiological Characterization Approval

Based on the results of this evaluation, EPA approves the addition of Waste Stream IN-ID-BTO-030 and finds that all requirements have been met. Based on this evaluation, there are no changes to the radiological characterization T1 or T2 designations. Characterization of any new waste stream not approved under the baseline or subsequent T1 evaluations or addition of containers to an approved waste stream that requires changing the established radionuclide scaling factors remains a T1 change. The tiering designations presented in Table 1 of the final report for EPA's 2014 continued compliance inspection of INL-CCP (see EPA Docket No. A-98-49; II-A4-190; July 15, 2014) remain in effect.

7.0 FINDINGS AND CONCERNS

Summary of Findings and Concerns

The EPA inspection team did not identify any findings or concerns relative to the addition of Waste Stream IN-ID-BTO-030 during this T1 change evaluation.

[12] Adding in quadrature is a standard statistical technique that allows one to consider the square root of the sum of the squares of the contributors to uncertainty, resulting in a lower value than what would be obtained if the values were simply added. For example, considering Table 7-3 of CCP-RC-INL-591, the TMU for ^{239}Pu is derived by taking the square root of $(42.7\%)^2$ plus $(25.0\%)^2$ plus $(10.0\%)^2$ plus $(12.8\%)^2$, which equals 52.1%, which is less than the value obtained by simply summing the individual uncertainty values (i.e., 90.5%).

8.0 CONCLUSIONS

Changes to Tiering

As a result of this evaluation, EPA did not make any changes to the INL-CCP RH T1 and T2 designations that were established during the baseline approval and modified during subsequent T1 evaluations and continued compliance inspections. The tiering designations presented in Table 1 of the final report for EPA's 2014 continued compliance inspection of INL-CCP (see EPA Docket No. A-98-49; II-A4-190; July 15, 2014) remain in effect and are listed as applicable in sections 6.1 and 6.2.

Approval

EPA concluded that the waste characterization processes of AK and radiological characterization used to characterize RH TRU Waste Stream IN-ID-BTO-030 are adequate, as evidenced by the records evaluated. There are no open issues relative to this T1 evaluation

Based on the results of this evaluation, EPA approves this T1 change to add Waste Stream IN-ID-BTO-030, consistent with the limitations specified in this report. INL-CCP may continue to characterize previously approved RH TRU waste consistent with the restrictions specified with the approvals listed in Attachment A to this report.

ATTACHMENT A

APPROVAL SUMMARY FOR INL-CCP REMOTE-HANDLED WASTE CHARACTERIZATION PROGRAM

Approved Activity	EPA Inspection Number, Approval Dates	EPA Docket Number
INL-CCP RH Baseline Approval	EPA-INL-CCP-RH-6.06-8, January 12, 2007	A-98-49; II-A4-72
T1 Change – Approval of WIPP Waste Information System	January 17, 2007	A-98-49; II-A4-74
T1 Change – Approval of Visual Examination	January 25, 2007	A-98-49; II-A4-75
T1 Change – Approval of Real-Time Radiography	February 12, 2007	A-98-49; II-A4-80
T1 Change – Approval of K Cell Wastes	January 1, 2008	A-98-49; II-A4-97
T1 Change – Approval of High-Range Gamma Probe for DTC	April 11, 2008	A-98-49; II-A4-98
T1 Change – Approval of Visual Examination Technique	September 22, 2009	A-98-49; II-A4-118
T1 Change – Addition of Twelve Containers to Waste Stream ID-ANLE-S5000 and Addition of Waste Stream ID-HFEF-S5400-RH	February 1, 2010	A-98-49; II-A4-122
T1 Change – Approval of Waste Stream ID-MFC-S5400-RH	June 8, 2010	A-98-49; II-A4-126
T1 Change – Approval of Waste Stream ID-INTEC-S5400-RH	August 17, 2010	A-98-49; II-A4-130
T1 Change – Addition of Lot 1B to Waste Stream ID-HFEF-S5400-RH	August 23, 2010	A-98-49; II-A4-131
T1 Change – Approval of Waste Stream IN-ID-NRF-153	November 1, 2010	A-98-49; II-A4-135
T1 Change – Approval of Waste Stream ID-RTC-S3000	November 1, 2010	A-98-49; II-A4-137
2010 Continued Compliance Inspection	March 16, 2011	A-98-49; II-A4-142
T1 Change – Addition of Lot 4A to Waste Stream ID-HFEF-S5400-RH	March 23, 2011	A-98-49; II-A4-145
T1 Change – Approval of Waste Stream IN-ID-NRF-SPC	March 12, 2012	A-98-49; II-A4-159
T1 Change – Addition of Lot 2 to Waste Stream ID-ANLE-S5000	July 25, 2012	A-98-49; II-A4-163
2013 Continued Compliance Inspection	July 16, 2013	A-98-49; II-A4-175
T1 Change – Approval of Waste Stream ID-EBR-S5000	April 16, 2014	A-98-49; II-A4-183
T1 Change – Addition of Lot 5C to Waste Stream ID-HFEF-S5400-RH	July 15, 2014	A-98-49; II-A4-186
T1 Change Approval of Waste Stream ID-MFC-SOLID-RH (Lot 5A)	September 10, 2014	A-98-49; II-A4-188
2014 Continued Compliance Inspection	July 15, 2014	A-98-49; II-A4-190

ATTACHMENT B

LIST OF DOE PERSONNEL PRESENT AT EVALUATION

Name	Affiliation	Audit Function/Expertise
David Ams	LANL-CO	AK Expert
Derek Ott	URS	Radiological Characterization Technical Expert
Douglas M. Pruitt	DOE-ID	DOE Observer
Ed Gulbransen	NWP-Areva	TRU Project Manager
Irene Joo	URS	RH Support
Jason Montoya	LANL-CO	AK Expert
Kevin Peters	SRS-CCP	AK Expert
Lisa Watson	INL-CCP	AK Expert
Marcus A. Pinzel	DOE	DOE Observer
Patsy Gilbert	LANL-CO	Site Docs
Scott Smith	INL-CCP	AK Expert
Steve Schafer	CCP	AK Expert
Thomas L. Clements, Jr.	CWI-INL	DOE Observer
Tom Morgan	CBFO	DOE Observer

ATTACHMENT C

LIST OF DOCUMENTS REVIEWED BY EPA DURING T1 EVALUATION

Analytical Chemistry Laboratory Data Packages: ADL12027A, January 24, 2013, Alpha Spectrometry; ADL12027B, January 10, 2013, Radio strontium; ADL12027G, January 10, 2013, Gamma Spectrometry; ADL12027I, February 14, 2013, Inductively Coupled Plasma-Mass Spectrometry; ADL12027L, January 17, 2013, Liquid Scintillation Counting

C127, Letter to Manager, Pittsburgh Naval Reactors Office, Re: Shipment of Special Nuclear Materials: PZA-CZC-3, E.F. Hlad, WAPD-DLO (E) F2069, December 14, 1987

C206, Letter to S.D. Harkness, Re: Request for Material Description and History of Thirteen Sludge Containers, D.I. Battista, WAPDOLO(MEL)O-860, March 17, 1989

C207, Letter to ANL, Re: Shipping Information, Westinghouse Electric Corporation, BAPL, no author cited, December 21, 1988

C208, Letter to Manager, Pittsburgh Naval Reactor Office, Re: Advance Notification PZA-CZC-1, E.F. Hlad, WAPD-OLO (E) F1857, May 11, 1987

C209, Letter to Manager, Pittsburgh Naval Reactors Office, Re: Advance Notification: PZA-CZG-2, E.F. Hlad, WAPO-DLO (E) F1915, July 21, 1987

C210, Letter to Manager, Pittsburgh Naval Reactors Office, Re: Advance Notification: PZA-CZC-4, E.F. Hlad, WAPD-DLO (E) F3010, January 29, 1988

C313, Email from Greg Smith to Lisa Watson, Re: Lot 3 sample material (with attached sample tracking spreadsheet titled "RCRA Samples"), Greg Smith, July 1, 2013

CCP Calculation Package: Determination of Reportable Radionuclides, D. Ott, INL-RH-126, Revision 0, October 3, 2013

CCP Calculation Package: DTC Spreadsheet Lot 3 Solidified Bettis Waste, D. Ott, INL-RH-129, Revision 0, August 26, 2013; Revision 3, April 22, 2014

CCP Calculation Package: INL Lot 3 Uncertainty Analysis, D. Ott, INL-RH-128, Revision 0, October 3, 2013

CCP Calculation Package: INL Solidified Waste from Bettis RH TRU Radiological Cs-137 DTC Correlation, D. Ott, INL-RH-127, Revision 0, September 3, 2013; Revision 2, January 22, 2014

CCP Calculation Package: Scaling Factor Development for Lot 3 Drums, D. Ott, INL-RH-125, Revision 1, September 3, 2013

CCP-AK-INL-590, Central Characterization Program Acceptable Knowledge Summary Report for Bettis Laboratory Remote-Handled Transuranic Waste Stored at Idaho National Laboratory Waste Stream IN-ID-BTO-030, Revision 3, July 31, 2013; Revision 4, March 31, 2014

CCP-AK-INL-592, Central Characterization Program RH TRU Certification Plan for 40 CFR Part 194 Compliance for Bettis Laboratory Remote-Handled Transuranic Debris Waste Stored at the Idaho National Laboratory, Waste Stream: IN-ID-BTO-030, Revision 1, August 16, 2012; Revision 2, March 25, 2014

CCP-RC-INL-544, Central Characterization Program RH TRU Certification Plan for 40 CFR Part 194 Compliance and Confirmation Test Plan, Revision 1, March 23, 2011

CCP-RC-INL-591, Central Characterization Program Remote-Handled Transuranic Radiological Characterization Technical Report for Bettis Laboratory Remote-Handled Homogeneous Waste Stored at the Idaho National Laboratory, Waste Stream: IN-ID-BTO-030, Revision 0, July 18, 2013; Revision 1, March 25, 2014

CCP-RC-INL-595A, Central Characterization Program Radiological Sampling and Analysis Plan for Bettis Laboratory Remote-Handled Transuranic Waste Stored at Idaho National Laboratory, Waste Stream: IN-ID-BTO-030, Revision 1, February 06, 2013

CCP-TP-005, Revision 24, Attachment 2, Record of Communication (see Reference C127)

CCP-TP-005, Revision 24, Attachment 11, Acceptable Knowledge Source Document Discrepancy Resolution (see Reference DR008)

CCP-TP-005, Revision 25, Attachment 1, Acceptable Knowledge Documentation Checklist, Waste Stream IN-ID-BTO-030, David Ams, July 31, 2013

CCP-TP-005, Revision 25, Attachment 4, Acceptable Knowledge Information List, David Ams, July 31, 2013

CCP-TP-005, Revision 25, Attachment 6, Waste Form, Waste Material Parameters, Prohibited Items, and Packaging, David Ams, July 31, 2013

CCP-TP-005, Revision 25, Attachment 8, Waste Containers List, David Ams, July 31, 2013

CCP-TP-005, Revision 25, Attachment 15, CCP TRU Waste Correlation and Surrogate Summary Form, Waste Stream IN-ID-BTO-030, Correlative Stream BT-T001, Lisa Watson, July 31, 2013

CCP-TP-005, Revision 26, Attachment 13, CCP Waste Stream Characterization Checklist, Unsigned Draft, provided November 29, 2013

CCP-TP-504, Central Characterization Program DTC Survey Procedure for Remote-Handled Transuranic Waste, Revisions 13, 14 and 15

Characterization Reconciliation Report, Unsigned Draft, file dated November 28, 2013

Characterization Reconciliation Report, Unsigned Draft, file dated December 3, 2013

Dose-to-curie Batch Data Report INLRHDTC13009, September 12, 2013

DR008, Attachment 11, Acceptable Knowledge Source Document Discrepancy Report Resolution (Beryllium), Jim Luginbyl, December 19, 2011

DTC for IN-ID-BTO-030 (lot 3).xls, October 17, 2013

Engineering Design File 10441, Configuration of Repackaged Bettis (Lot 3) Remote Handled Transuranic Waste, Revision 0, January 28, 2013

Lot 3 Sample Data Rev 0.xls, October 17, 2013

P100, The United States Naval Nuclear Propulsion Program, Naval Reactors, July 31, 1998

Post-Sampling Memorandum, Analysis of Sample Data for INL Lot 3, from Jene Vance to Irene Joo, February 25, 2013

Sampling Batch Data Reports: IDRH1101 (5 samples), IDRH1201 (3 samples)

U201, News Release: Bettis Atomic Power Laboratory Celebrates 50th Anniversary, B.J. Schramm, undated

U212, Operation Record of Met Cell Equivalent Gram Loss, NA, Book #2 and #3, various dates from March 3, 1982, to November 11, 1986

U213, Grinding Equivalent Gram Loss Logbook No.1, dated February 1977 through February 1981

U217, COW #3 Old Slow Speed COW, Waste Disposal Log Cell 12, March 17, 1980

U221, Materials Evaluation Laboratory Examination Forms for IN-41 Solidification, R.E. Bright, MEL 116 through MEL 14, April 14, 1987, to July 13, 1987

U236, COW Book #2, Waste Disposal Log, January 1973 through November 1979

U237, Logbook, COW (Diamond) Waste Disposal Log, Cell 12, Start date February 25, 1982 through March, 1985

U256, Bettis Experimental Facilities, Bettis Hot Laboratory, November 1978

U277, RH TRU Container Repackaging Datasheet – HFEF IDBLANL880107 and HFEF IDBLANL880164, Form-880 Revision 7, November 7, 2011

U366, Excerpt from Occupational Logbook for RH Solid Sampling conducted by CCP at INL, June 20, 2013

Waste Stream Profile Form, Waste Stream IN-ID-BTO-030 and Summation of Aspects, Unsigned Draft, files dated November 28, 2013, and December 3, 2013